SEVENTH ANNUAL REVIEW OF ACTIVITIES, PROJECT RESUMES
1982

Information Circular 82-1

NATURAL RESOURCES
NEW BRUNSWICK
RESSOURCES NATURELLES
NOUVEAU-BRUNSWICK

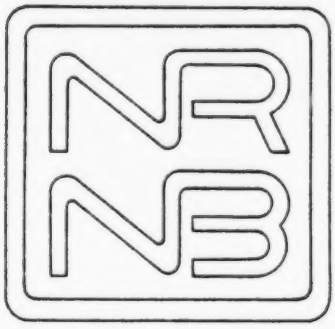
This report has been prepared by:

Mineral Resources Division
Department of Natural Resources
Province of New Brunswick

Hon. Gerald S. Merrithew, Minister

1982

Seventh Annual Review of Activities
Project Resumes
1982



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Department of Natural Resources
New Brunswick

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NORTHERN NEW BRUNSWICK

J. L. Davies, Regional Geologist

The Bathurst Regional Office, located at 495 Riverside Drive, Bathurst is staffed by J. L. Davies, Regional Geologist, J. A. MacIntosh, Assistant Regional Geologist, Sharon McKinnon, Administrative Officer, Maurice Belland, Technician, and André LeBlanc, Technician.

For the first time in nearly 12 years the field activities of the Bathurst Office in 1982 were funded by the Province.

GEOLOGICAL MAPPING, MAP-AREA O-9

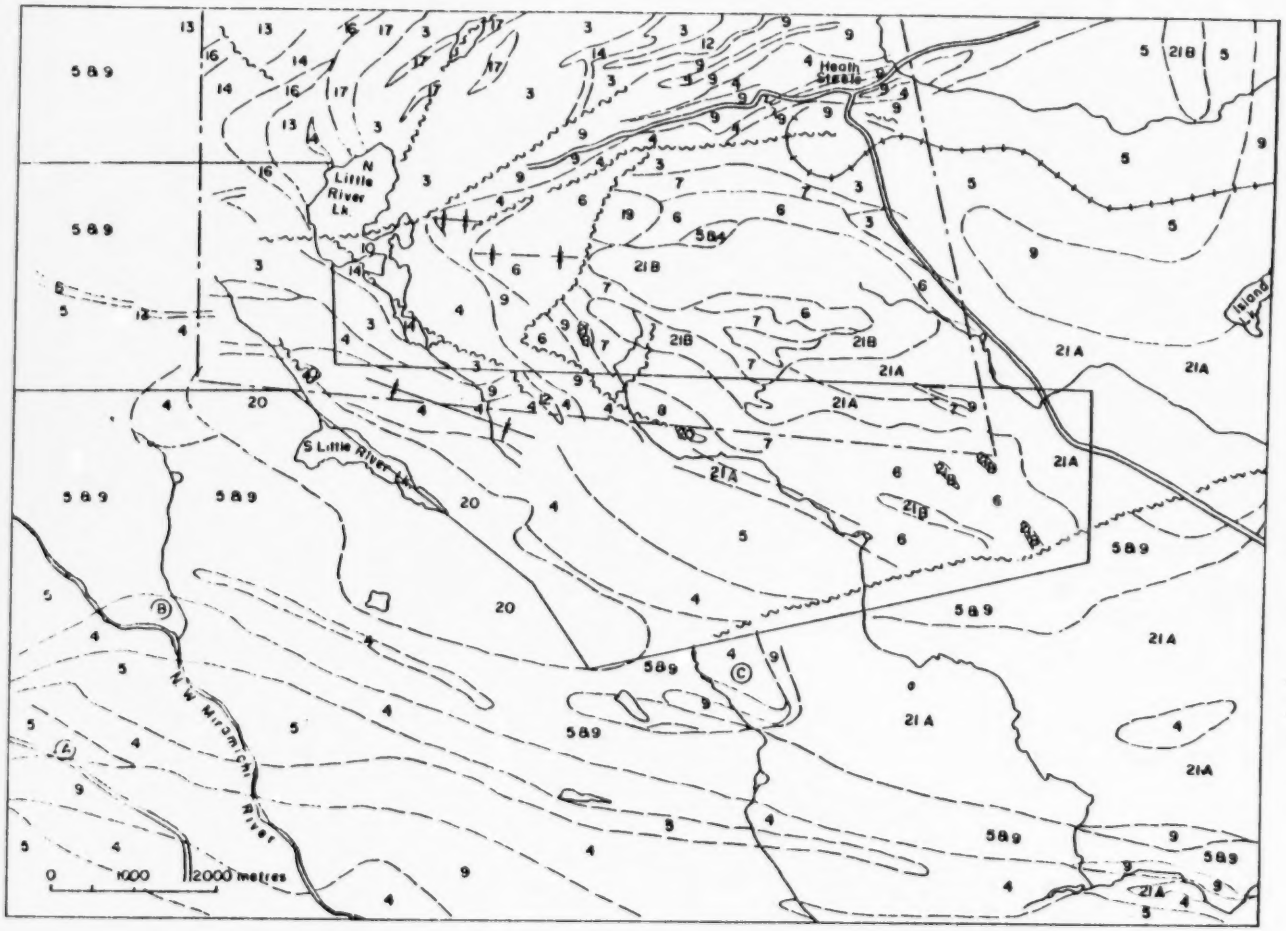
J. MacIntosh continued geologic mapping in sheet O-9 that he began in 1981. The mineral potential of this area has been of interest since Heath Steele Mines Limited began production in 1957 from their ore-bodies in the northeast corner of the sheet. The known geology suggests that the favourable zone continues to the west and southwest in O-9. During the subsequent twenty-five years, several projects were carried out by the government to establish the geology beyond the mine area. The first and most extensive of these studies was that of R. Clark who traversed the area at intervals of 200 metres. A manuscript map (1959) at 1:15,840 issued from this field work, but no report, or detailed legend was submitted. In 1973 preliminary sheet 73-6 was published by R. R. Irrinki as part of a thesis covering O-9 and eight adjacent sheets (O-10, O-11, N-9, N-10, N-11, P-9, P-10 and P-11). In 1979, L. Owsiacki mapped parts of O-9 and O-8 map-areas surrounding the Stratmat and Heath Steele deposits. A manuscript copy of this work (1 inch equals 800 feet) towards a thesis is available. At the same time R. Morgan mapped west and southeast of Heath Steele for which several unpublished sheets are available. J. MacIntosh mapped the south half of O-9 in 1981 and 1982, traversing at intervals of 200 metres. R. Irrinki did some revision mapping in O-9 during 1982 as part of geological mapping of the Big Bald Mountain area (21 O/1).

Figure 1 shows the location of the areas mentioned above. Also shown is the generalized geology, compiled from these sources. Some conclusions from the work of J. MacIntosh in 1981 in the southeastern quarter were presented in Information Circular 81-1, pp. 3-6. Little more can be added to this at present. The work of the 1982 season in the southwestern quarter bears out the general trends and lithology shown on Preliminary Sheet 73-6. Compilation and laboratory work in progress will provide considerable additional data on rock types, structure, and distribution. Magnetite-bearing sedimentary rocks, appearing at numerous points in the southeast quarter, are much more restricted to the west. Two occurrences are mentioned here. At point "A", on the Fraser-Burchill road, is an horizon 30 to 60 metres wide, of weakly magnetic, chloritic rocks. This area corresponds with the centre of a broad, weak, magnetometer anomaly on Map 20, 178G (High Resolution Aeromagnetic Series, 1975). Weakly biotitic, basic volcanic rocks, and fine-grained meta-sedimentary rocks occur here. The trend of the anomaly as shown is roughly perpendicular to the trend of the rock groups shown on Preliminary Sheet 73-6.

At point "B", north of the Southwest Miramichi River, an horizon of magnetite iron formation, in beds to 4 cm thick of massive magnetite and averaging about 10% magnetite across a width of 1.5 m, was traced for about 100 m.

At point "C", just east of Mountain Brook and near the southeast end of the South Little River Lake granodiorite, a small amount (1-2%) of pyrite is present in a phyllitic schist, possibly 100 metres wide with abundant medium- to coarse-grained feldspar and quartz crystals.

Structural conditions appear more variable at the outcrop level, in the western limit of the area mapped by the author, in the vicinity of the Northwest Miramichi River. At three or four localities from south to north, flat-lying to low-plunging, upright, minor folds are common (half wavelengths to 30 cm). These folds fold an earlier foliation, presumably the regional vertical to steeply dipping foliation, but no clear examples of refolded bedding were found. Their relationship to the regional northeast-southwest cross-foliation with steeply to moderately, southwesterly plunging minor drag folds was not established.



LEGEND

TETAGOUCHE GROUP

21B	Metagabbro
21A	Metabasalt
20	Metagranodiorite
19	Feldspar-quartz metaporphyry
17	Lapilli breccia, siliceous
16	Dacitic feldspar, crystal tuff
14	Lapilli breccia
13	Porphyritic metarhyolite
11	Laminated tuff
9	Quartz-feldspar tuff
8	Andesite lapilli tuff
7	Massive potassic metarhyolite
6	Vent facies breccia
5	Felsic volcanic rocks
4	Metasedimentary rocks
3	Feldspar crystal tuff
2	Chloritic tuff-breccia

L. Owslacki

R. Mor[illegible]

Folds (axial plane trace)

Fault

© For explanation see report

Figure 1. Geology of map-area 0-9

The South Little River Lake foliated granodioritic body appears remarkably uniform in texture and composition, its granularity varying from medium- to coarse-grained and its variation in mineralogy involving principally biotite and chlorite. No inclusions were found. What appears to be apophyses of similar granitic rock, were found in both the north and south walls. Small quartz veins, irregular to geometrically arranged are common. Locally, minor pyrite was noted. The granodiorite at South Little River Lake forms a large-block felsenmeer, apparently related to frost-action and movement of the blocks toward the centre of the basin of the lake. Blocks up to 5 metres across, frequently grouped and showing their derivation from a larger single block or outcrop, pave the shallower margins of the lake for 20 to 40 metres from the shore and disappear from sight down the steeper slope beyond. Rounded, glacial erratics are rare, and rock material less than 10 cm across is scarce along the shore. The lake offers an interesting environment for scuba diving and studies in geomorphology.

STREAM SILT SURVEYS

Over 3000 silt samples collected in the Serpentine Lake (21 O/2), Sisson (21 O/6), Kedgwick (21 O/11) and Upsalquitch Forks (21 O/10) areas in 1981 have been analyzed for Pb, Zn, Cu, Mo, Fe, Co, Ni, W, Mn, Ag and U during 1982 (Figure 2). The results are now being plotted and the writer anticipates the publication of the maps early in 1983.

The 1982 campaign involved the Sisson (21 O/6) and Riley Brook (21 O/3 west) areas. Precise Surveys and Water Management Surveys collected approximately 3000 silt samples plus 300 heavy mineral samples.

CORE STORAGE

The long awaited core storage library has now been completed adjacent to the Forest Service Tree Nursery at Madran, approximately 22 km north of Bathurst. Over 100,000 feet have been racked inside the building that is designed to hold about 190,000 feet. Core was received in 1982 from Newmont Mining Company (Norland Property), Placer Development (Portage Lakes Property), and Brunswick Mining and Smelting (several properties). Billiton Canada Limited submitted 25,000 feet from the Restigouche Zn-Pb-Ag deposit.

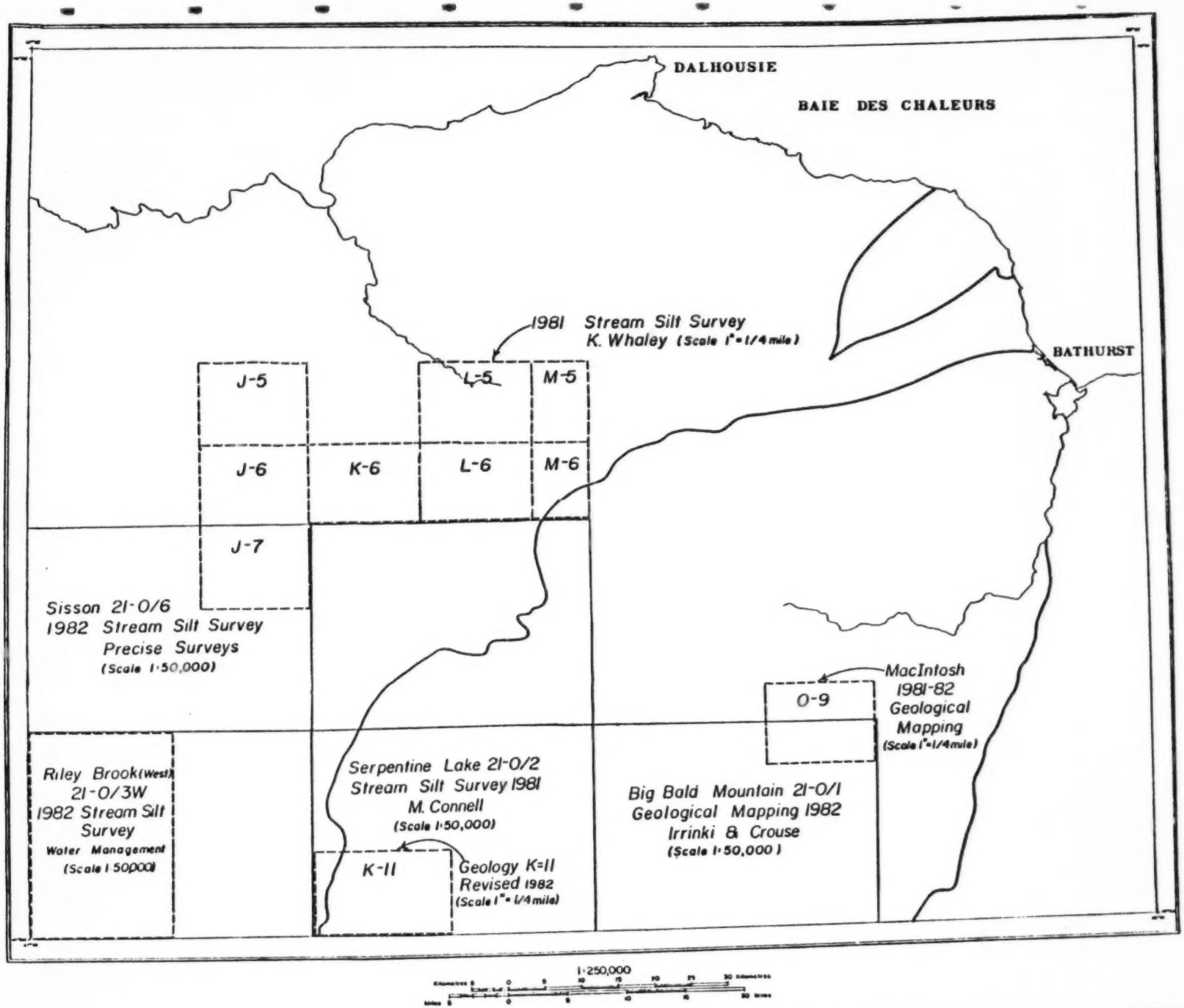


FIG. 2 GEOLOGICAL AND GEOCHEMICAL PROJECTS, 1982. BATHURST REGIONAL OFFICE

BIG BALD MOUNTAIN PROJECT

R. R. Irrinki and G. W. Crouse collected the geological information to update existing maps in the area. Newly exposed sections along recently constructed roads were studied in detail and previously examined sections were re-examined for a better understanding of the stratigraphy and structure of the area. Recently submitted assessment data will be incorporated into the present work. (Figure 3)

The area is underlain by a Cambrian-Ordovician quartzite-phyllite-slate sequence which is interlayered with felsic volcanic rocks towards the top of the unit. This sequence is overlain by a felsic volcanic sequence comprising predominantly rhyolite, rhyolite tuff, porphyritic rhyolite and crystal tuff (augen schist) and minor interlayered sedimentary and mafic volcanic rocks. The felsic volcanic sequence is overlain by black slates and mafic volcanic rocks. Ordovician gabbro and granite and Devonian granite intrude the above sequences.

The pre-Silurian rocks are affected by at least four phases of deformation; northwest and east-northeasterly trending faults also complicate the stratigraphy of the area. The rocks have also undergone greenschist-amphibolite facies regional metamorphism.

Although significant amounts of base metal mineralization have been found throughout the felsic volcanic sequence, the base of the sequence is a favourable exploration target area for massive sulphide deposits. Devonian granite plutons are favourable for tin, tungsten, and uraniun mineralization.

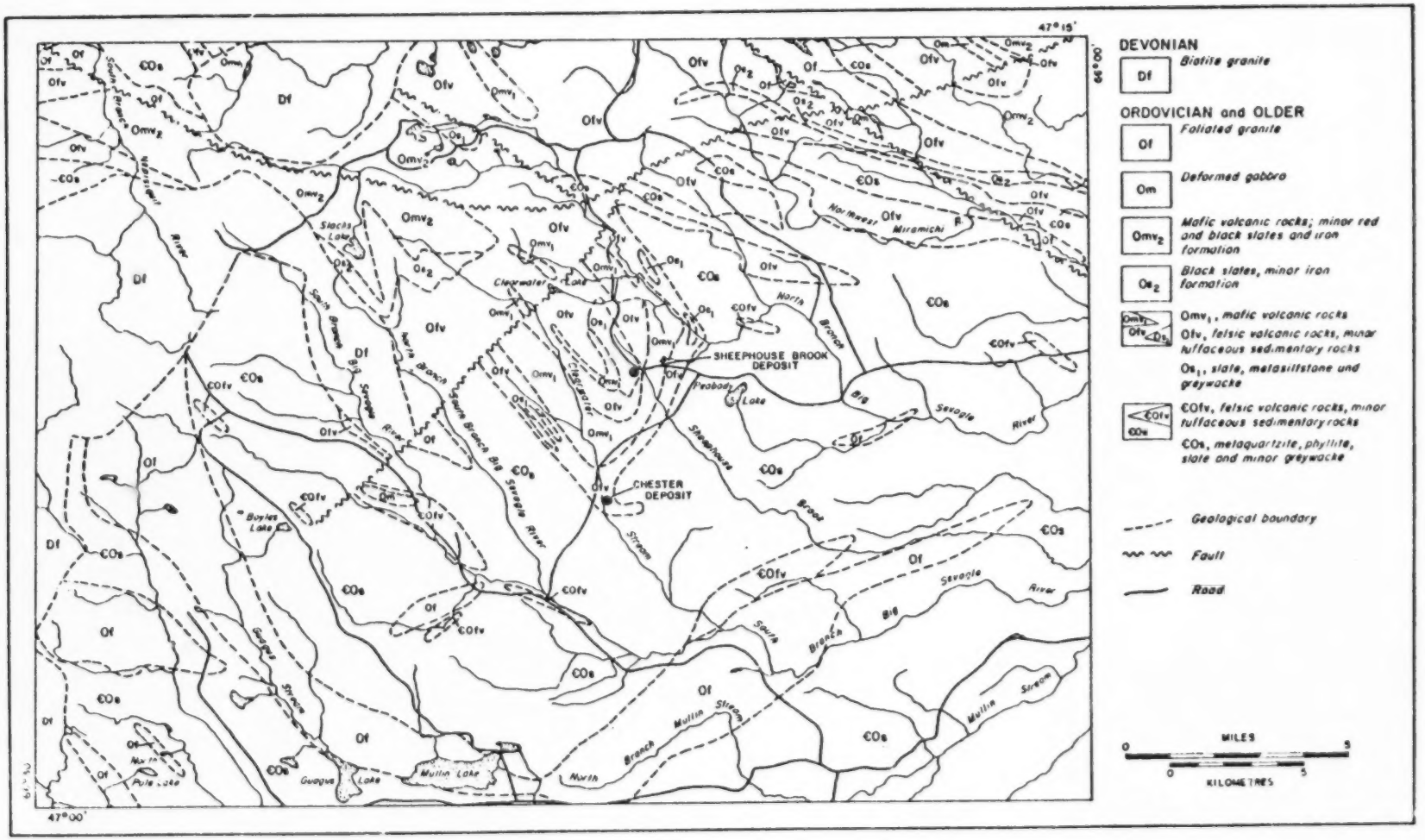


Figure 3. Geology of Big Bald Mountain map-area (21 O/1)

SOUTHERN NEW BRUNSWICK

A. A. Ruitenberg, Regional Geologist
S. R. McCutcheon, Assistant Regional Geologist

The Sussex Regional Office is staffed by A. A. Ruitenberg, Regional Geologist; S. R. McCutcheon, Assistant Regional Geologist; M. R. Mazerolle Engineering Technician; and Mrs. Freda H. Kelly, Clerk-typist. V. N. Rampton and R. D. Thomas of Terrain Analysis and Mapping Ltd. were hired on contract for the summer months.

Several projects were carried out during the season. S. R. McCutcheon started a detailed study of the stratigraphy, structure and mineralization of the Mount Pleasant Caldera. R. D. Thomas and V. N. Rampton conducted a sampling and heavy mineral analysis program of tills overlying the eastern St. George batholith. A. A. Ruitenberg started an assessment of the gold potential of southern New Brunswick.

At the request of the Department of Municipal Affairs, the environmental geology of the village of North Head on Grand Manan Island and the town of St. Andrews were investigated.

A field trip on the tin-tungsten-molybdenum and antimony deposits in southern and central New Brunswick was given for participants in the I.G.C.P. (International Geological Correlation Program) Meeting that was held in Fredericton during August. The last two days of an I.G.C.P. field trip in the Avalon and Meguma Zones of Newfoundland, Nova Scotia and New Brunswick were organized by our staff.

In addition to these projects, several prospects were examined at the request of exploration geologists and prospectors. Geologic advice to the New Brunswick Forest Site Classification Council was continued.

At the annual meeting of the Geological Association of Canada, S. R. McCutcheon gave a paper on the Windsor Group evaporites in southern New Brunswick. At this same meeting A. A. Ruitenberg presented a paper on predictive metallogeny in granitoid intrusions in New Brunswick. S. R. McCutcheon gave a paper on the potash potential of the Central New Brunswick Platform at the Canadian Institute of Mining and Metallurgy 84th annual general meeting in Quebec and one on stratigraphy as a guide to potash exploration in the Windsor Group of southern New Brunswick at the CIMM District 1

meeting in Fredericton. A. A. Ruitenberg presented a paper on metallic mineral zonation related to tectonic evolution of the New Brunswick Appalachians, at the Fredericton meeting of the International Geological Correlation Program. At the request of the organizing committee for the Canadian Institute of Mining and Metallurgy District Meeting in Fredericton, A. A. Ruitenberg organized a tin-tungsten-molybdenum-antimony symposium and he presented a paper on the regional setting of these deposits in New Brunswick.

GEOLOGY OF THE MOUNT PLEASANT CALDERA

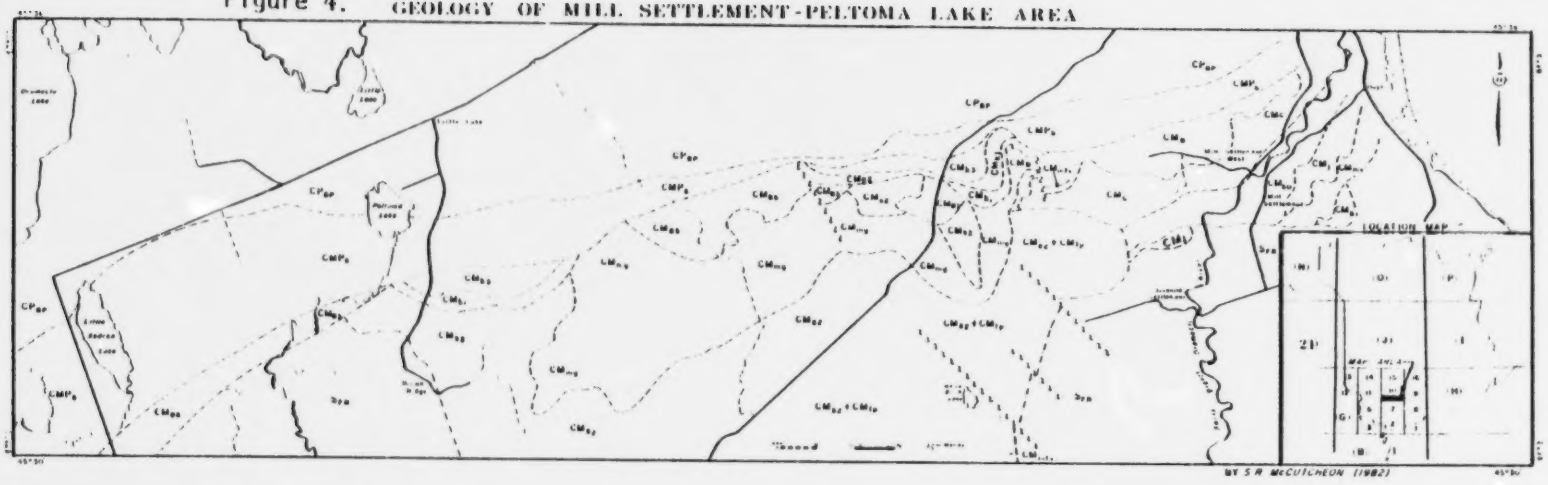
This project was carried out by S. R. McCutcheon and it will be continued next year. The purpose of the project is mainly to resolve some stratigraphic problems in the Shin Creek-Mount Pleasant area, a block of ground which contains one existing mine and several interesting mineral showings. The economic potential of this area made it essential that these problems be resolved as an aid to future exploration.

Geologic mapping was started in the eastern part of the area where diamond drill core was available. This was very helpful in determining the stratigraphic relationships in the vicinity of Mill Settlement, one of the problem areas. Working westward, the stratigraphic position of other units was resolved by reference to this known section.

The results of the summer's mapping are summarized by a simplified geologic map (Figure 4) and a stratigraphic correlation chart (Table 1). The following points merit emphasis:

1. The Shin Redbeds unconformably overlie the Piskahegan Group and undoubtedly are equivalent to Hopewell Group rocks in the Moncton Subbasin. The Shin Redbeds locally contain clasts of Windsor limestone at their base and are conformably overlain by grey sandstone of the Boss Point Formation indicating that they are post-Middle Viséan to pre-Late Namurian or Early Westphalian in age. The Shin Redbeds contain a few felsic tuff layers in the upper part and numerous calcrete zones throughout, one of which is the Gelder Limestone of van de Poll (1967).
2. The Piskahegan Group can be divided into intra- and exo-caldera sequences and it can be further divided as to whether the rocks are pre- or post-caldera collapse.

Figure 4. GEOLOGY OF MILL SETTLEMENT-PELTOMA LAKE AREA



CP_{BP} (Boss Point Formation); CMP_S (Shin Creek Redbeds); CM_{K3} (Kleef pumice tuff);
CM_{K2} (Kleef Basalt); CM_{K1} (Kleef Conglomerate); CM_{BS} (Big Scotch Mountain Formation);
CM_{mg} (porphyritic microgranite) CM_{fp} (feldspar porphyry); CM_{S2} (Seelys Porphyry);
CM_B (Bailey Rock Formation (Lithodeme)); CM_{mfv} ("M-M Unit");
CM_C (Carrow Formation); CM_{SO} (South Oromocto Basalt); CM_J (Juvenile Formation);
CM_{mv} (unnamed basalt); CM_{S1} (Sophia Formation)

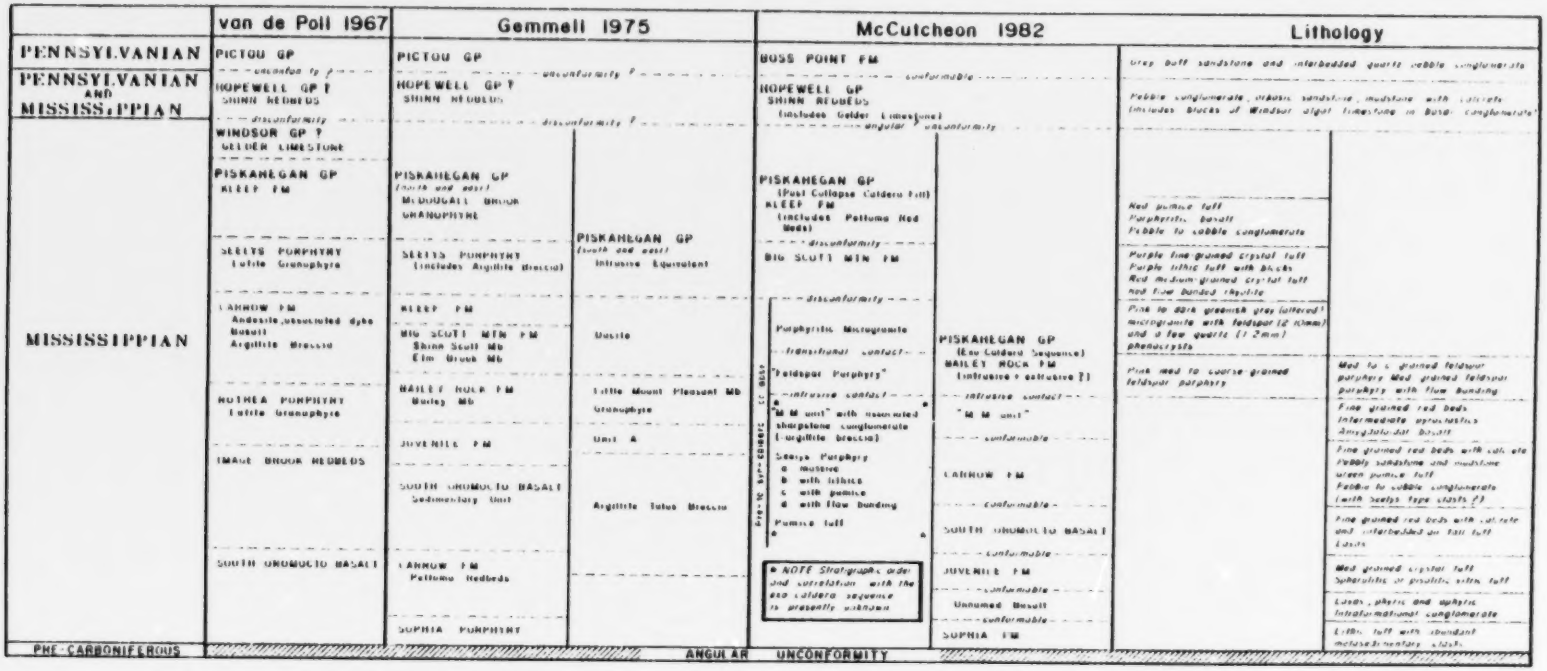

van de Poll 1967
Gemmell 1975
McCutcheon 1982
Lithology
PENNSYLVANIAN
PENNSYLVANIAN AND MISSISSIPPIAN
MISSISSIPPIAN
PRE-CARBONIFEROUS
ANGULAR UNCONFORMITY
PICTOU GP
HOPEWELL GP ?
SHINN REDBEDS
WINDSOR GP ?
GELDER LIMESTONE
PISKAHEGAN GP
KLEEP FM
SEELYS PORPHYRY
LAHAVE FM
ROTHEA PORPHYRY
SMAIL BROOK REDBEDS
SOUTH UNIMUCIS BASALT
BOSS POINT FM
BIG SCUTT MTN FM
BAILEY HOCK FM
LAHAVE FM
JUVENILE FM
SOPHIA PORPHYRY
SOPHIA FM
Grey buff sandstone and interbedded quartz pebble conglomerate
Red pumice tuff
Porphyritic basalt
Pebble to cobble conglomerate
Purple fine grained crystal tuff
Purple lithic tuff with blocks
Red medium grained crystal tuff
red fine banded rhyolite
Pink to dark greenish gray laltered? microgranite with feldspar (2 10mm) and a few quartz (1 2mm) phenocrysts
Pink med to coarse grained feldspar porphyry
Med to c grained feldspar porphyry Med grained feldspar porphyry with flow banding
Fine grained red beds Intermediate pyroclastics Amygdaloidal basalt
Fine grained red beds with calc ate Pebbly sandstone and mudstone green pumice tuff Pebble to cobble conglomerate (with Seelys type clasts ?)
Fine grained red beds with calcite and interbedded air fall tuff Lavas
Med grained crystal tuff Spherulitic or pisolitic lithic tuff
Lavas, phyric and aphyric Intraformational conglomerate
Lithic tuff with abundant

Table 1. Stratigraphic correlation chart of the Mill Settlement-Peltoma Lake Area

3. The post-collapse caldera fill sequence comprises the Big Scott Mountain and Kleef Formations. The Kleef Formation contains a distinctive reddish brown, tubular pumice tuff (Table 1) that was not previously recognized. In one outcrop, an latered or weathered zone in rocks immediately below the Kleef Formation, suggests that they were exposed at surface for some time before burial.

4. The exo-caldera sequence is best developed in the Mill Settlement area and comprises several distinct units (Table 1), one of which, the "M-M Unit", also occurs in the intra-caldera sequence. In addition, the Bailey Rock unit is believed to be correlative to the "feldspar porphyry". These units provide a well-defined correlation between the upper parts of the intra- and exo-caldera sequences. However, correlation between the lower parts of the two sequences is less clear. Clasts of Seelys-type rocks in the Carrow Formation suggest that most of the intra-caldera volcanic rocks are pre-Carrow, but this remains to be verified. The contact between the intra- and exo-caldera sequences, with the exception of the "M-M Unit" (Table 1), is intrusive and/or faulted.

5. The pre- to syn-collapse intra-caldera sequence is not well defined at present because of insufficient mapping (to be done next year). However, it consists of extrusive and intrusive rocks. The "M-M Unit", the Seelys Porphyry or "quartz-feldspar prophyry" and a pumice tuff (Table 1) comprise the currently known extrusive rocks. The "feldspar porphyry" and porphyritic microgranite, or "granophyre" of previous workers, are intrusive. *Senso stricto* the intrusive rocks are post-collapse but they are closely related to caldera development and therefore included with the syn-collapse sequence. The porphyritic microgranite generally occupies the internal part of the caldera and is topographically low, whereas the "quartz-feldspar" and "feldspar porphyries" are generally marginal and topographically high.

6. Alteration and mineralization of the Mount Pleasant type preceded emplacement of the post-collapse caldera fill sequence. They are concentrated around the caldera margin and resulted from hydrothermal activity that was largely post-magmatic, i.e. geothermal. Silicification of the marginal rocks caused them to be more resistant to erosion resulting in their generally higher, present-day, topographic relief.

EASTERN ST. GEORGE BATHOLITH PROJECT

This project was carried out by R. D. Thomas with the assistance of summer students. V. N. Rampton advised on the interpretation of surficial units, C. F. Gleeson on heavy mineral sampling, and A. A. Ruitenberg on indentification of till lithologies.

The Eastern St. George Batholith is composed of a well-fractionated, multiphase, S-type granitoid complex of Carboniferous age. Numerous tin-tungsten-molybdenum occurrences have been found associated with the youngest phases of this complex.

A till sampling program was carried out to delineate favourable exploration targets in parts of the granitic complex that are covered by glacial till. In order to interpret the results of the survey, a reconnaissance surficial geologic mapping program (including detailed examination of the till lithologies) was carried out simultaneously with the sampling. Heavy mineral concentrates were prepared using the method outlined below:

1. Samples were screened in the field to 1/4 inch (7-10 kg)
2. 1/4-inch material was sluiced and panned in the base camp (1-2 kg)
3. Panned concentrate was sent to the geochemical laboratory, dried, weighed, and screened to 10 mesh. The +10 mesh material was stored.
4. The -10 mesh material was weighed and subjected to tetrabromethane separation (1.G 2.96). The light fraction was stored.
5. The heavy fraction was dried, weighed and split. A portion (0.5 g) was returned for microscopic examination, and the remainder was pulverized to -100 mesh and geochemically analyzed.

The heavy mineral concentrates are being analyzed for tin, tungsten, and gold. Samples collected from the B horizon were analyzed for Cu, Pb, Zn, Mo, Ag, U, and Sb. Additional samples taken from the L, H, A, and B horizons are being analyzed for plant nutrients by the Maritime Forest Research Centre Laboratory in Fredericton. The plant nutrient analyses together with lithologic composition of the tills, soil texture, and drainage will be used as aids to determine the forest potential of the ground.

ASSESSMENT OF THE GOLD POTENTIAL OF SOUTHERN NEW BRUNSWICK

This project was carried out by A. A. Ruitenberg, on a part-time basis, during the summer and early fall. Increased interest in gold required an assessment of the gold potential of southern New Brunswick. The project will be continued next year.

Gold-bearing quartz veins were found around the turn of the century at several localities in southern New Brunswick. The most significant of these veins are hosted by Ordovician sedimentary rocks of the Cookson Formation, near Rolling Dam and in rocks referred to as the "Mispeck Group", along the Bay of Fundy coast. None of these occurrences, however, had potential for economic development.

The prospect for economically viable gold-deposits in southern New Brunswick improved significantly with the recent discovery by Mr. Morton Gordon of an extensive gold-bearing, hydrothermally altered zone at Cape Spencer, east of Saint John. The host rocks were assigned to the "Mispeck Group" in the past, but they more closely resemble highly deformed Cambrian or Eocambrian strata in the Eastern Volcanic Belt, farther east along the Bay of Fundy coast.

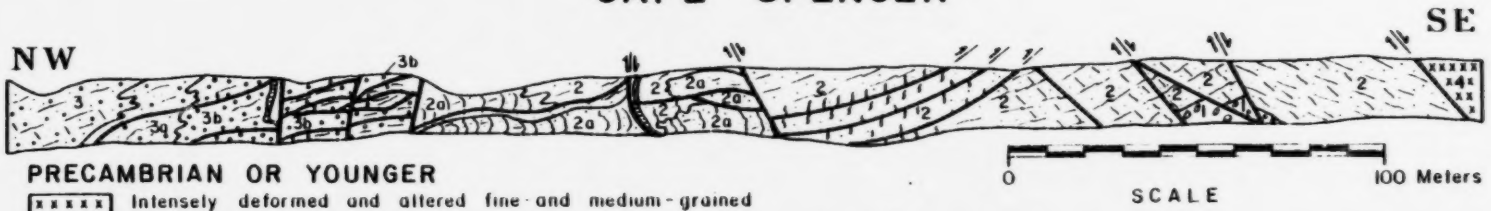
The unaltered rocks at Cape Spencer are greenish and purplish grey slate, siltstone and sandstone. The finer grained rocks show a well-defined penetrative cleavage (S_1) mostly sub-parallel, but locally at a considerable angle to bedding. In places a second cleavage (S_2), mostly at a high angle to S_1, can be recognized (Figure 5). Immediately east of the latered and mineralized zone, these rocks are cut by prominent, westerly dipping thrust faults that are mostly sub-parallel or at a low angle to S_1. Thin tension fractures filled with barren quartz veinlets are commonly in the thrust zone. The thrust faults are cut by younger normal faults.

The gold-bearing, hydrothermally altered rocks occur in northeasterly trending, crudely lens-shaped bodies that occupy an area of about 200 m by 400 m. The gold occurs both in the quartz veins and the intensely silicified, sericitized and pyritized wall rocks. The most intensely altered and mineralized rocks are coarse-grained sandstones, but original textures are mostly obliterated. This area appears to be the locus of well-developed, easterly overturned mesoscopic F_2 folds. The folded S_1 cleavage is mostly

Figure 5.

SECTION TROUGH GOLD-BEARING ROCKS

CAPE SPENCER



PRECAMBRIAN OR YOUNGER

4 — Intensely deformed and altered fine- and medium-grained granite

2 / 2a — Greenish and purplish grey slate, siltstone and sandstone 2a, silicified, sericitized and in part pyritized equivalents with abundant quartz veins and varying amounts of gold

Greenish and purplish grey conglomerate and sandstone

3, 3a, 3b — * Greenish and purplish grey, fine-grained sandstone, and siltstone; 3a, silicified, sericitized and in part pyritized equivalents with abundant quartz veins and varying amounts of gold; 3b, intensely silicified, sericitized and in part pyritized, coarse-grained sandstone with gold-bearing quartz veins

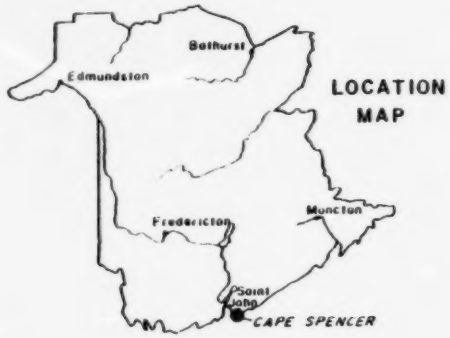
* *stratigraphic position unknown*

Thrust and normal fault respectively

Cleavage S1 (mostly sub-parallel to bedding) and folded equivalent mostly impregnated with quartz veins

Cleavage S2

quartz-filled tension fractures



BY: *A.A. Ruitenberg and S.R. McCutcheon, 1982*

impregnated by irregularly shaped, gold-bearing quartz veins, which generally represent the earliest mineralization. These veins are locally cut by a second, northwest-striking, steeply dipping, and usually more hematite-rich set of gold-bearing quartz veins.

In addition to detailed mapping of the gold-bearing rocks at Cape Spencer, a reconnaissance survey was carried out in the Musquash-Black River area. Prominent thrust zones with abundant quartz veins were observed in coastal sections near Musquash, Chance Harbour, Black River and Mispeck. A prominent micaceous and pyrite-rich alteration zone, similar to Cape Spencer, was found along a thrust fault at McKenzie Brook, in the village of Mispeck (about 2.5 km northwest of Cape Spencer). More detailed work is required to fully delineate the areas most favourable for gold deposits in southern New Brunswick, but altered volcanic and sedimentary rocks occupying fault zones in the Eastern Volcanic Belt undoubtedly merit exploration.

ABSTRACTS AND REPORTS PUBLISHED IN 1982

McCUTCHEON, S. R. 1982. Windsor Group evaporites in southern New Brunswick: an example of deep water - deep basin deposition. Abstract, Geological Association of Canada Meeting, Winnipeg, Manitoba.

McCUTCHEON, S. R. 1982. A stratigraphic guide to potash exploration in the Windsor Group of southern New Brunswick. Abstract, Canadian Institute of Mining and Metallurgy Third Meeting, District 1, Fredericton.

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BEDROCK MAPPING - WEST CENTRAL NEW BRUNSWICK

Les Fyffe

Map report 82-2 entitled "Geology of upper parts Becaguimec, Keswick and Nashwaak Rivers-Cloverdale-Millville map-areas (I-19, J-19, J-20)" by D. V. Venugopal has been published. Map report 82-1 entitled "Geology of Juniper-Knowlesville-Carlisle area (I-16, I-17, I-18)" by C. St. Peter, now at the printer, is the only report remaining to be completed.

A coloured geological map of the Woodstock area (1:250,000 scale) has been published and is available in folded or flat form (Map N.R.-4).

During this year's field season several projects were carried out. A geological survey was made of the January 9, 1982 earthquake area and a report prepared entitled "Geology in the vicinity of the 1982 Miramichi Earthquake" by L. R. Fyffe (Open File Report 82-27). Outcrops at Grand Falls in northwestern New Brunswick were briefly examined in conjunction with a project being undertaken by the Department of Tourism.

The writer, accompanied by W. H. Poole of the Geological Survey of Canada, spent part of the summer attempting to ascertain the stratigraphic succession of Silurian rocks in the Fredericton Trough of the Stanley area in central New Brunswick. A graptolite locality on Hayes Brook was re-collected and identification of these should aid in unravelling the complex structure in this area.

The writer and S. R. McCutcheon of the Sussex office examined Silurian rocks in southern New Brunswick in order to establish correlation with those of central New Brunswick (Table 2). Plant fossils recovered from calcareous sandstone on Davis Brook a few kilometres east of McAdam proved to be Devonian age of the upper part of the Fredericton Trough succession and appear to substantiate the existence of plant fossils reported by Bailey and Matthew in 1872 from similar rocks farther south at Flume Ridge.

Graptolites were discovered this summer by the writer in slate on Belle Brook southwest of Woodstock and confirmed the Middle Ordovician age of these rocks. Dr. W. Forbes of the University of Maine in Presque Isle

TABLE 2. Suggested correlation of pre-Carboniferous units across the Fredericton Trough.

		Miramichi Highlands northwest of Trough		Fredericton Trough		Rolling Dam area southeast of Trough	
				northeast	southwest		
DEVONIAN	Famennian					Perry Formation •	
	Frasnian						
	Givetian						
	Eifelian						
	Emsian						
	Siegenian						
	Gedinnian				Plume Ridge Formation •	Mascarene Group	Eastport Formation •
SILURIAN	Pridolian			Kingsclear Group	Digdeguash Formation		Waweig Formation •
	Ludlovian			Burtts Corner Greywacke • •			Oak Bay Formation
	Wenlockian						
	Llandoverian			red and green slate			
ORDOVICIAN	Ashgillian						
	Caradocian	Tetagouche Group	Belle Lake Slate •				
	Llandeilian		Pocomoonshine Volcanics				
	Llanvirnian						
	Arenigian		black slate at Benton •				
	Tremadocian						
CAMBRIAN			quartzite and phyllite			Cookson Formation •	

• fossil control

recovered graptolites from Lower Ordovician slate at Benton, south of Woodstock. Although Bailey originally reported the locality in 1900, this was the first successful attempt to re-collect it. Interestingly, Bailey's original specimens of *Dictyonema* from the same exposures (stored at the University of New Brunswick) suggest a slightly older age than the didymograptids collected by Forbes.

A summary of stratigraphic names in use in New Brunswick is being prepared for "Lexicon of Canadian Stratigraphy, Volume VI, Atlantic Canada" to be published by the Canadian Society of Petroleum Geologists as part of an eight-volume set. The synopsis of each unit includes its name, age, author, type locality, lithology, thickness and distribution, relations to other units, age justification, history, and references. The write-ups are scheduled to be completed by the end of February, 1983.

Reprints of the following articles are available upon request:

FYFFE, L. R. 1982. Taconian and Acadian structural trends in central and northern New Brunswick. *In* Major structural zones and faults of the northern Appalachians, *edited by* P. St. Julien and J. Beland, Geological Association of Canada, Special Paper 24

RUITENBERG, A. A. and FYFFE, L. R. 1982. Mineral deposits associated with graitoid intrusions and related subvolcanic stocks in New Brunswick and their relationship to Appalachian tectonic evolution. Canadian Institute of Mining and Metallurgy, v. 75, pp. 83-97.

GEOPHYSICS

J. J. Chandra

GRAVITY SURVEYS

1. Gravity surveying was continued in the southern extremity of the Central Carboniferous Basin. In particular, the Fredericton Junction and Fredericton (1:50,000 scale) sheets were covered. This program was conducted jointly with the Mineral Development Branch (Tim Webb) whose interest was the determination of possible target areas of salt-potash deposition. The additional gravity coverage has allowed detailed structural modelling which is underway (*maps on display*).

2. A gravity survey was conducted in the Miramichi Earthquake epicentral region. This project was undertaken with the assistance of K.B.S. Burke of the University of New Brunswick. The results of the survey have provided some understanding of the area in terms of structure, depths and shapes of the poorly exposed geologic units. Modelling studies are presently underway in determining probable causes of mechanisms for the recent quakes. This modelling is being done by incorporating other geophysical data such as magnetics and seismicity. All information to date is on display.

SEISMIC SURVEYS

Refraction seismic surveys were conducted at several Strong Motion Accelerometer (S.M.A.) sites in the Miramichi Earthquake epicentral region. The data was required for the proper interpretation of S.M.A. records and was also needed for modelling purposes.

GEOTHERMAL STUDIES

The Geological Surveys Branch (Dept. of Natural Resources, N. B.) is at present co-operating with the Geothermal Section of Earth Physics Branch (Energy, Mines and Resources, Ottawa) in the locating and drilling of three 400 m holes in the Pokiok and St. George granites and in the southern portion of the Central Carboniferous Basin. The three sites were selected on the

basis of radiogenic heat studies jointly completed by the Earth Physics Branch and the Geological Surveys Branch. The three holes will be cored and geophysically logged for geothermal heat gradients. Cost of the drilling and logging is borne by Earth Physics Branch and the project is field-managed by John Leslie and Associates.

Modelling studies of the sites will be undertaken by Geological Surveys Branch and will involve ground heat data, magnetics and gravity (*maps on display*).

GRAVITY COMPILATION

All gravity data gathered by Geological Surveys Branch, Earth Physics Branch, the University of New Brunswick and the private sector were combined to make up a comprehensive network of 22,671 gravity stations. The combined gravity data set has been compiled in a series of 1:50,000 maps covering all of New Brunswick and includes sheets for the Northumberland Strait, Bay of Fundy and adjacent parts of Quebec and Nova Scotia. The data distribution by map-sheet is indicated in Figure 6. Some of these maps are on display.

As part of the compilation program, modelling studies were completed on the following gravity anomalies associated with salt: Smithtown, Salina, Salt Springs, Millstream, Plumweseep, Penobsquis, Five Points, Portage Vale, Anagance and Pointe de Bute (*on display*).

Listings of all 22,671 gravity stations are available by map-sheet on paper or as a whole on magnetic tape.

SATELLITE IMAGE ANALYSIS

Work is anticipated to start in December on the interpretation of Landsat imagery of the southern portion of the Central Carboniferous Basin and the Pokiok and St. George granites. The objectives of the study would be to create a linear map of the area and the detection of potential sites for salt, sulphide minerals, and aggregate material.

Some training areas to be used are the Consolidated Durham mine, Mount Pleasant, St. Stephen nickel deposit and the Blagdon gravel operation at Welsford.

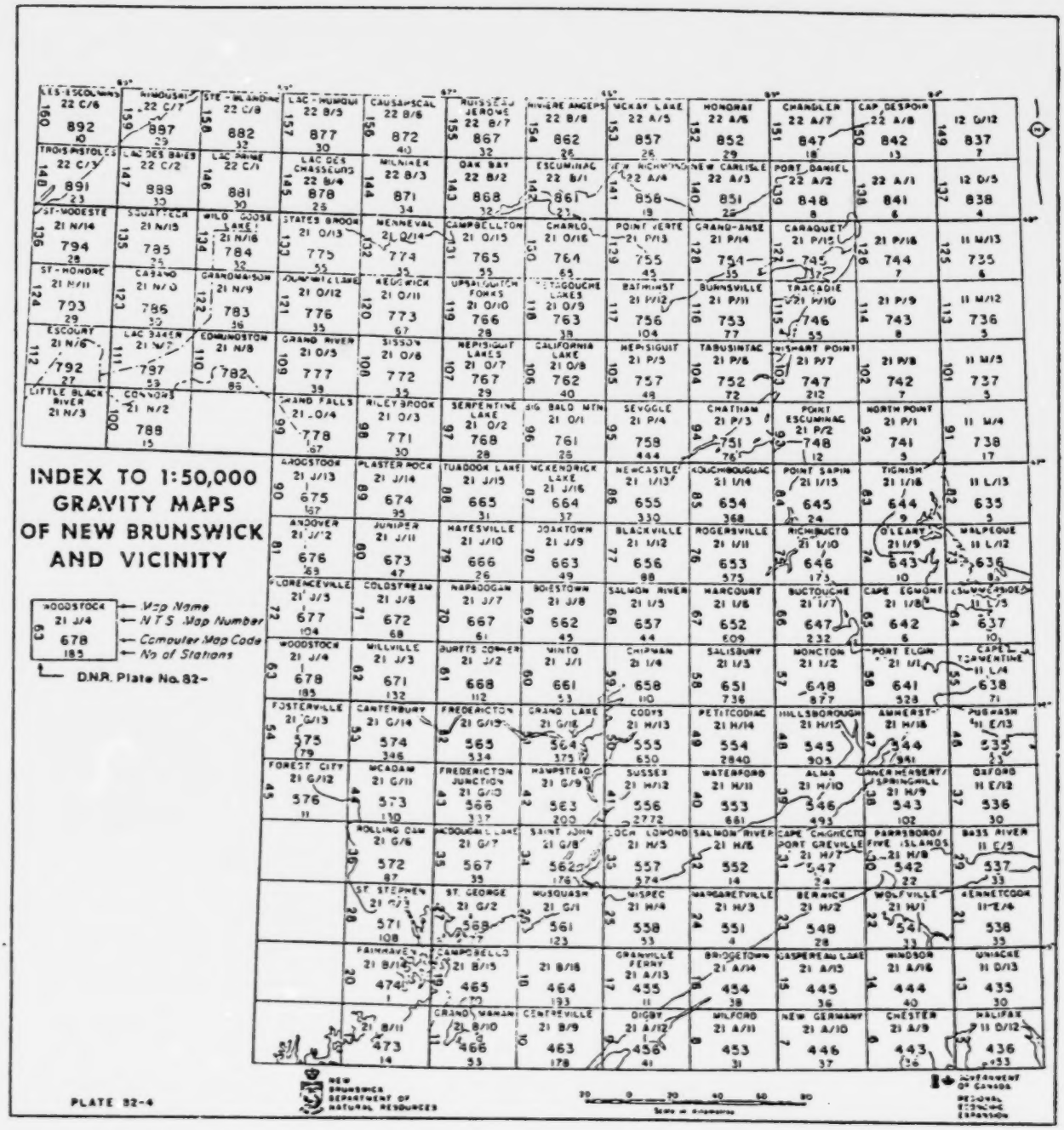

INDEX TO 1:50,000 GRAVITY MAPS OF NEW BRUNSWICK AND VICINITY
Map Name
N.T.S. Map Number
Computer Map Code
No. of Stations
D.N.R. Plate No. 82-
PLATE 82-4
NEW BRUNSWICK DEPARTMENT OF NATURAL RESOURCES
DEPARTMENT OF CANADA

Figure 6. Index to 1:50,000 Gravity Maps of New Brunswick and Vicinity.

CONSULTING SERVICES

Consulting services were provided to various engineering, exploration and mining companies active in the area. Field assistance was also given to local prospectors.

Considerable time was spent with visiting geophysicists and geologists from Ottawa and the United States. Work involved mapping of earthquake activity in the Holmes Lake-Indian Lake area.

GEOSCIENTIFIC AND INFORMATION SERVICES DATA CENTRE

D. J. J. Carroll

During the past year, the Mineral Resources Division continued to microfilm the incoming mineral exploration assessment file reports. In addition, the majority of our Division's map plates were also microfilmed.

Both these document types were also coded for entry into the National bibliographic computer data base, called GEOSCAN. However, due to a change-over in the Geological Survey of Canada's GEOSCAN data base management system, neither 1982 assessment reports nor map plates were entered into the new system.

The Mineral Resources Division in 1982 also continued to offer prospecting courses, expanding the previous lecture series from six sessions to ten.

Early in the new year, six courses in total were offered: in Saint John, Fredericton (2), Chatham, and Bathurst (2). In addition to offering the course in English, it was decided to also offer a course in French in Bathurst. Total enrolment for this series of courses was 73 registrants.

Because of the continued interest in the prospecting course, a second series of 1982 lectures is being conducted this fall in Saint John, Fredericton and Bathurst. Total enrolment for this session is 44.

Plans for the upcoming year include the continuation of our microfilming program, updating our information data base in GEOSCAN, and the commencement of work on a revised List of Publications.

INDUSTRIAL MINERAL RESOURCES

Donald E. Barnett, Industrial Minerals Geologist

AGGREGATE RESOURCES

The objective of this program is to map granular aggregate resources in the McDougall Lake and Blackville regions (Figure 7) and thereby continue the provincial inventory of these resources for future use. Mapping is at a scale of 1:50,000.

The work was carried out by "in house" geological staff on N.T.S. map-sheets 21 I/12 (Blackville) and 21 G/7 (McDougall Lake).

In addition to the granular aggregate resources study on N.T.S. 21 G/7, a more detailed surficial geological study was undertaken to assist the Forest Management Branch in a forest site classification pilot project which involves not only climatic regions but also geomorphologic districts and regolith systems.

McDOUGALL LAKE (21 G/7) MAP-AREA (*Jacques Thibault*)

The granular aggregate resources of the McDougall Lake (21 G/7) map-area are outlined in Figure 8. Very large volumes of good to excellent quality fine and coarse aggregate are associated with the ice-contact deposits and the valley train outwash. Generally poorer grade material is found in association with the ablation till deposits.

Two main ice-contact systems are found:

1. the Magaguadavic-Oxbow Brook-McDougall Lake system, and
2. the Meadow Brook-South Oromocto Lake-Victoria Lake system.

The deposits associated with these two systems are generally composed of good to excellent quality sand and gravel; textural variability characterizes these deposits.

A valley train outwash deposit located at the south end of McDougall Lake contains large volumes of well stratified, moderately well sorted sand and pebble gravel.

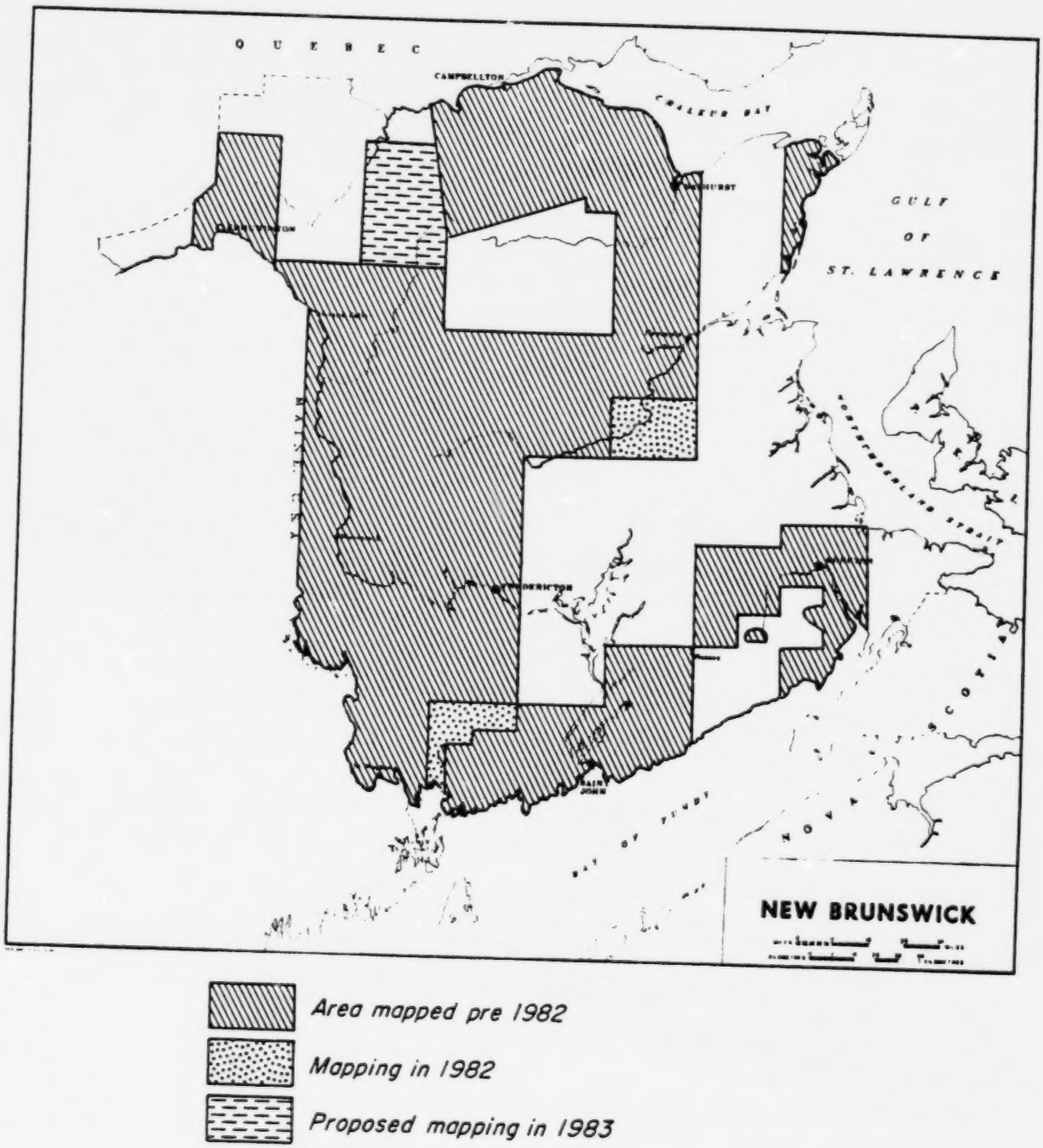


Figure 7. Map showing progress of granular aggregate resource mapping in New Brunswick.

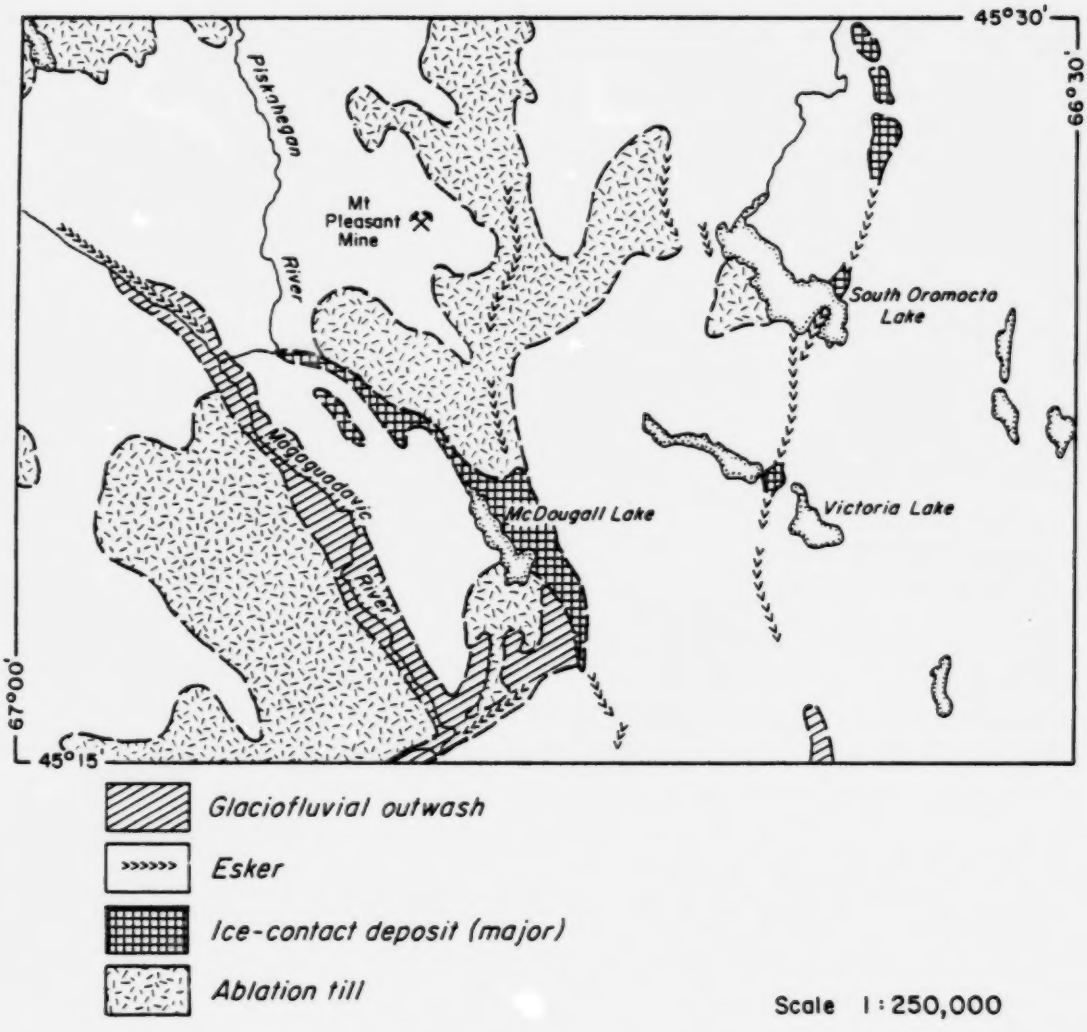


Figure 8. Map showing the granular aggregate resources of the McDougall Lake (21 G/7) map-area.

Extensive portions of the map-area identified as ablation till contain significant volumes of low grade material. Some minor glacio-fluvial deposits are also associated with that unit. This material is commonly being used locally as a source of fill for logging roads.

BLACKVILLE (21 I/12) MAP-AREA (*Allen Seaman*)

The granular aggregate resources of the Blackville (21 I/12) map-area are outlined in Figure 9. Very large volumes of aggregate are associated with the ice-contact complex deposits along the east side of the Southwest Miramichi River, north of its confluence with the Cains River, and with the large esker which extends eastwards past Despres Lake. Much smaller volumes of material are associated with the discontinuous esker systems along the Bartholomew River, and in the area to the south of the Cains and East Branch Sabbies Rivers.

These deposits exhibit considerable textural variability, both laterally and vertically, being composed of both fine and coarse aggregate. The fine aggregate present is generally of good to excellent quality. Portions of the Despres Lake esker are operated to provide fine concrete aggregate for the Moncton area. The coarse aggregate is of only poor to fair quality, due to the high proportion of soft sandstone clasts present. It is frequently cobbly or bouldery.

Over most of the map-area, the upper one to two metres of the sandstone bedrock is highly shattered. This material, combined with the thin overlying till, has been extensively used as a source of fill, particularly for use in logging road construction.

SURFICIAL GEOLOGY (*D. Barnett*)

Dr. Vern Rampton of Terrain Analysis and Mapping Services Ltd. continued his work to produce a surficial geology map of New Brunswick at a 1:500,000 scale. The work during the fiscal year 1982-83 is being funded by the Geological Survey of Canada under the direction of Dr. Bob Fulton.

Work in 1982 involved further field verification as well as numerous discussions with Drs. Nelson Gadd, Vic Prest, Doug Grant and Claude Gauthier of the G.S.C. Messrs. Jacques Thibault and Allen Seaman of the

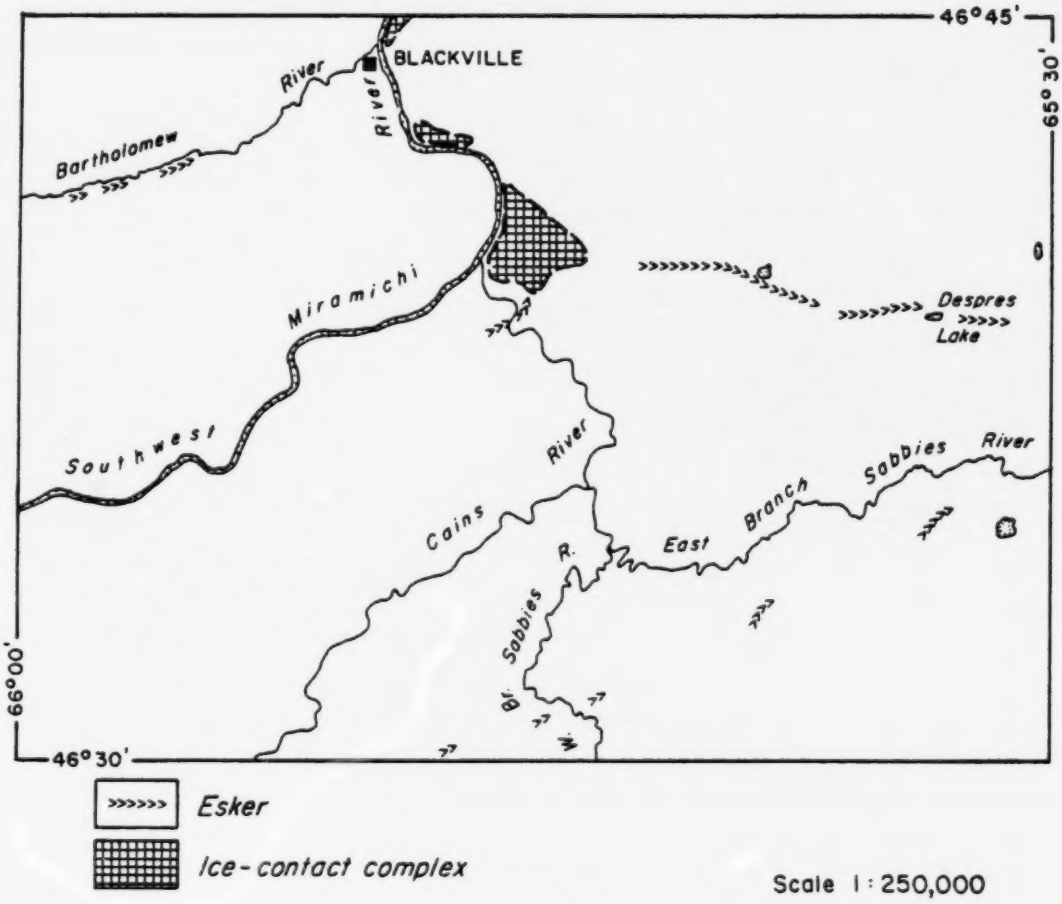


Figure 9. Map showing the granular aggregate resources of the Blackville (21 I/12) map-area.

New Brunswick Department of Natural Resources continued to provide detailed information for the compilation.

Work is scheduled for completion by March 31, 1983 and will include a coloured map and report in the usual G.S.C. format.

A RE-EXAMINATION OF THE GEOLOGY AROUND SAINT JOHN

K. L. Currie
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario
K1A 0E8

Re-mapping of the Saint John (21 G/8E) and Loch Lomond (21 H/5W) map-areas at 1:50,000 scale by a multi-disciplinary team has resulted in substantial revisions to older maps (Figure 10). The Brookville Gneiss, a mesocratic quartz-feldspar-hornblende-biotite gneiss which contains an Aphebian component, forms a basement, though one which has been repeatedly remobilized. After initial metamorphism and partial melting of the Brookville Gneiss, the Green Head Group was laid down upon it as a stable shelf sequence, probably in Helikian time. In Hadrynian time a major episode of magnetism, accompanied by metamorphism of the Brookville Gneiss, emplaced a series of acid to basic plutons. As a result of metamorphism and plutonism, the Brookville Gneiss was remobilized and rose diapirically through the overlying Green Head Group, producing a kind of piercement structure. The Green Head Group was strongly metamorphosed along the contact with the hot diapir, and elsewhere the marbles of the Group flowed freely, carrying along with them the more rigid siltstones in which the previous structural history is recorded. In late Hadrynian time the mainly volcanic Coldbrook Group, including the West Beach Formation previously thought to be Carboniferous in age, formed to the east and west of the diapiric anticline. Possibly the Coldbrook Group may be genetically related to the major Hadrynian plutonism. If so, the Saint John region lay in the roots of a major Andean-type volcanic arc at this time.

Deposition of the Saint John Group commenced in earliest Cambrian time on a gradually subsiding shelf. We found no evidence of major unconformity between the Saint John and Coldbrook Groups, and the interval of non-deposition may have been relatively short, since small amounts of acid volcanic ash appear in the Saint John Group. Metamorphism of the Saint John Group lies below chlorite grade, but anatectic melts in the central diapiric core have yielded an Ordovician K-Ar age, suggesting that deposition of the Saint John

Group was terminated by the Taconic Orogeny. The juxtaposition of high and low grade rocks of Ordovician age must be ascribed to normal faults. Granitic rocks in the central core younger than the dated Ordovician material are tentatively thought to be Devonian. The Acadian Orogeny seems to have produced little metamorphism. A wide-spread swarm of diabasic dykes cutting the Saint John Group may be of Acadian age.

Carboniferous sedimentation commenced with molasse-type conglomerate of the Kennebecasis Formation, derived mainly locally and from the northwest. Roughly simultaneously, deposition of the Balls Lake and Lancaster Fromations commenced on the proximal and distal parts respectively of alluvial fans fed by detritus derived from northwesterly advancing thrust sheets. These sheets advanced over an essentially autochthonous terrane, as well as their own sedimentary debris, at least as far west as Little River, although relicts of the sheets are now left only along the sea coast. These relicts locally contain exotic material presumed derived from a major terrane not now seen in southwestern New Brunswick. In late Carboniferous (Stephanian) and later time the sheets were inactive and became buried in coarse, clastic sediment derived from upfaulted blocks. In addition to producing intense, gently dipping cleavage, the thrusting tightened and probably re-oriented older structures.

In the overthrust terrane, large scale quartz veining, presumably due to quartz dissolved during formation of the cleavage, occurs widely. The largest veins lie just below the sole thrust, forming masses up to 15 m across, as well as complex networks of veins of at least three ages. These veins locally contain significant gold values. Slightly younger breccias locally contain sparse copper mineralization.

LEGEND

QUATERNARY

Q_g gravel, sand, stratified sand, till

----*unconformity*----

CARBONIFEROUS

P_u red sandstone and conglomerate, minor coaly beds and siltstone; grades to P_l at base

----*relations uncertain*----

C_t allochthonous thrust slices bounded beneath by thrust faults; mainly shattered to sheared granodiorite to quartz diorite and granitic schist, possibly equivalent to H_g; minor limestone; thin conglomerate slices, probably equivalent to $^gMP_{bl}$

----*fault contact*----

P_l Lancaster Formation: grey litnic arenite, minor quartz pebble conglomerate, red sandstone and shale

----*gradational contact*----

MP_{bl} Balls Lake Formation: red polymict conglomerate, red siltstone and shale; minor red to pink sandstone; no marble boulders

----*relations uncertain*----

M_k Kennebecasis Formation: red to chocolate conglomerate, minor sandstone; typically rich in marble boulders

----*unconformity*----

DEVONIAN

D_g hornblende leucogranite, massive pink granite with large square quartz

----*intrusive contact*----

CAMBRIAN AND ORDOVICIAN

C_{sj} Saint John Group: minor basal conglomerate, orthoquartzite, greenish grey sandstone and greywacke, black shale, quartz-rich siltstone

----*unconformity or disconformity*----

HADRYNIAN

H_c Coldbrook Group: (a) acid tuff, crystal tuff, agglomerate, flow-banded rhyolite; minor red shale and siltstone, conglomerate; (b) greenish-black tuff, lapilli tuff, agglomerate; minor intermediate to mafic flows; (c) basalt flows, amygdaloidal basalt, pillow basalt, gabbro; all units moderately to strongly epidotized

----*unconformity, locally intrusive contact*----

H_g granitoid plutonic rocks; biotite-hornblende quartz diorite to granodiorite, minor epidote alaskite; migmatite of H_g and H_b

----*intrusive contact*----

H_b gabbro, diorite, hornblendite; altered mafic rocks and amphibolite, mafic rocks with alkali feldspar megacrysts; dykes and dyke complexes

----*intrusive contact*----

HELIKIAN (?)

H_{gh} Green Head Group: grey-blue to buff calcite and dolomite marble, fine quartzite, rusty black siltstone and semi-pelitic schist

----*unconformity*----

APHEBIAN (?)

A_b Brookville Gneiss: mesocratic quartz-feldspar-hornblende-biotite gneiss with amphibolite lits; metasomatized equivalents of A_b; minor gneissic biotite leucogranite

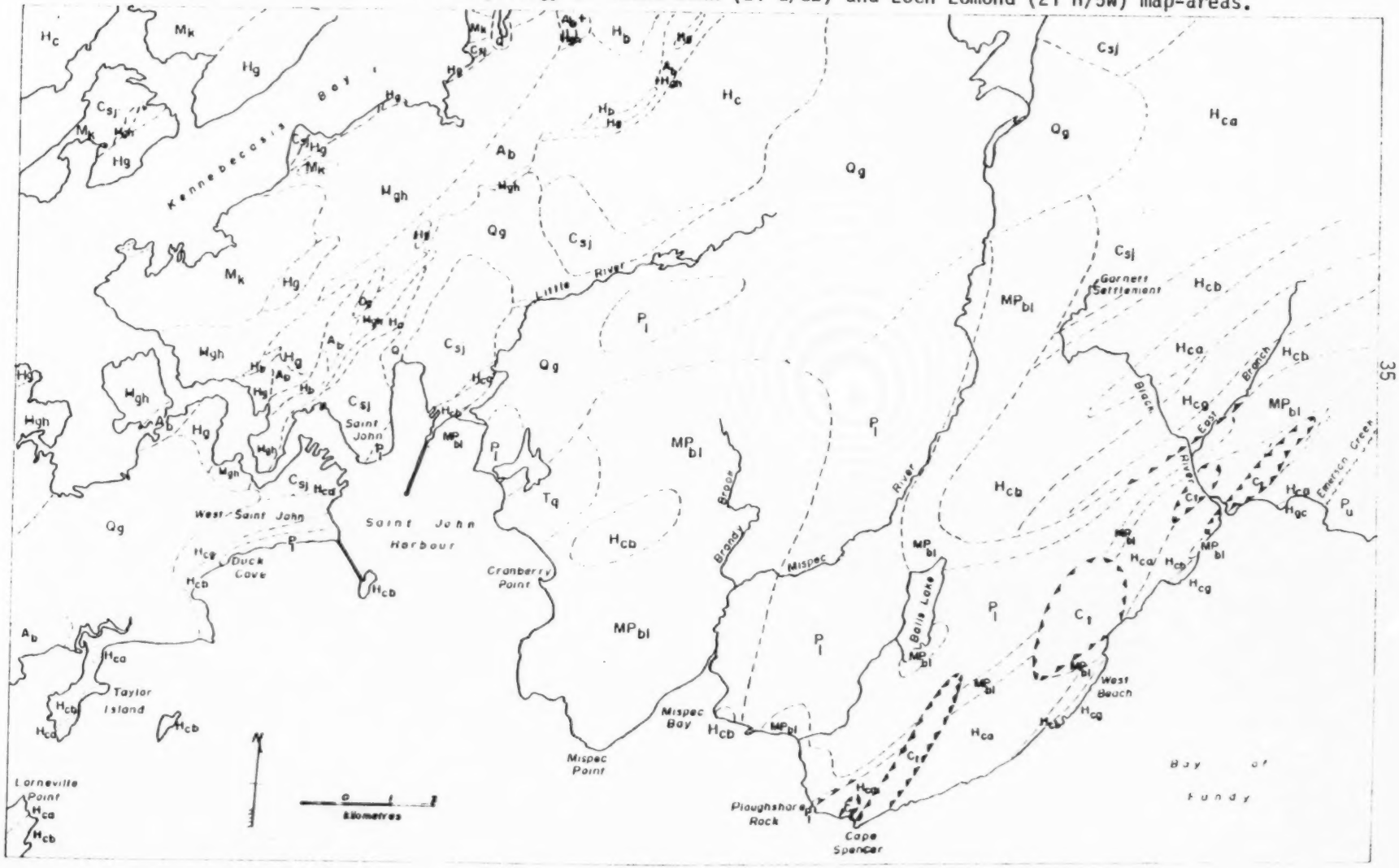
geological contact, approximate

high-angle fault, approximate

thrust fault, hachures on thrust plate

Geology by K. L. Currie 1980, 1982, R. D. Nance 1980, 1982, R. K. Pickerill 1980, G. E. Pajari 1980

Figure 10. Revision of the geology of Saint John (21 G/8E) and Loch Lomond (21 H/5W) map-areas.



NEW BRUNSWICK RESEARCH AND PRODUCTIVITY COUNCIL MINERAL DEVELOPMENT AND PROCESSING ACTIVITIES

R. S. Boorman

The New Brunswick Research and Productivity Council is a contract organization with revenues approximating $4 million/year of which the provincial government grant represents less than 14 per cent.

The various skills and capabilities of RPC are grouped into seven interdisciplinary units with the Mineral Development and Processing Department being directly responsible for mineral resource related projects. During the past year the more significant projects undertaken by the group included:

1. RPC Sulphation Roast Process, development
2. Coal/oil shale, combustion/retort
3. Enhanced silver recovery for Brunswick Mining and Smelting
4. Pyrohydrolysis of low level radioactive wastes
5. Electrochemistry projects
6. Miscellaneous service work

ENERGY RESOURCES

D. E. Gemmell, Energy Resources Geologist

During the past year, under the energy resources segment, the following projects were carried out (two of which are discussed in more detail in this report):

1. Carboniferous Drilling Project
   (a) Completed reports and CARBDRIL file, and
   (b) Crushed and analyzed rock chip samples with results to be released in early 1983
2. Peatland Inventory in the counties of Queens, Sunbury and Charlotte
3. Coal beneficiation and rehabilitation:
   (a) Continued to work with intergovernmental committee to define specs for mechanical coal washing plant, and
   (b) Rehabilitation responsibilities were transferred to G. Greer
4. Oil shales:
   (a) Phase 2 of coal-oil shale combustion tests; ie. scrubber generator technique,
   (b) Finalization of report on lithotypes and carbon typing from existing cores,
   (c) Commenced field investigation of intrastratigraphic relationship of the Albert Formation, and
   (d) Finalized reports on microwave technology of oil extraction
5. General administration of pipelines and underground storage

PEATLAND INVENTORY (*D. Keys*)

Field investigations of the Province's peatlands have now been completed and the project is in a report finalization phase. All field data has been input on a computer file. Calculated data can be retrieved at the site or bog level as well as in a regional compilation. Over 600 variables can be used as selection parameters to provide regional groupings.

Since 1975 core samples were recovered and logged at over 20,400 sites on 817 peatlands. Grid lines totaling 1,485 km were used to locate sites on 214 larger peatlands. Peatlands with lower development potential were investigated using traverse points. Over 4,200 sites on 603 peatlands were investigated in this manner.

Contoured peat isopach maps are available for each peatland with elevation maps also available for all grid bogs. Two hundred and eighty-four map sets at 1:10,000 scale display this information. Two profiles (displaying the distribution of peat types and humification degrees) are available, or in preparation, for some 1,138 grid lines.

It is now estimated that there are about 140,000 hectares of peatland in the Province. The 132,500 hectares studied excluded peatlands in National Parks or Military bases as well as those less than 25 hectares in size. The surveyed peatlands comprise over 2.4 billion cubic metres of peat. Some 67,800 hectares comprising 2.1 billion cubic metres had peat depths exceeding 1 metre and are considered potentially mineable.

In addition to the inventory program, project staff continued to assess utilization options and assist potential developers. Testing of carbon products is continuing while interest in horticultural peat development remains at a high level. Project staff participated in the organization of a national peat symposium recently held in Shippagan and led field trips. Presentations were made at a number of other conferences during the past year. Publications resulting from these presentations include:

HENDERSON, R. E. and DOIRON, R. 1981. Some identification hints for the field classification of peat. Organic Soil Mapping and Interpretation Workshop, September 15-18, 1981, Fredericton, New Brunswick. (In press)

KEYS, D. 1982. Summary of the techniques used in the inventory of the peatlands of New Brunswick, Canada. Peatland Methodology Workshop, March 9 and 10, 1982, Ottawa, Ontario. (In press)

KEYS, D. 1982. The effect of peat type and decomposition on the calorific value of some New Brunswick peats. ASTM Symposium on the Testing of Peats and Organic Soils, June 23, 1982, Toronto, Ontario. (In press)

KEYS, D., GEMMELL, D. E., and HENDERSON, R. E. 1982. New Brunswick peat -- resources, management, and development potential. Symposium '82 "A Symposium

on Peat and Peatlands", September 12-15, 1982, Shippagan, New Brunswick.

KEYS, D. and HENDERSON, R. E. 1982. Field and data compilation methods used in the inventory of peatlands of New Brunswick, Canada. ASTM Symposium on the Testing of Peats and Organic Soils, June 23, 1982, Toronto, Ontario. (In press)

KLEMETTI, V. and KEYS, D. 1982. The relationships of bulk density, moisture content, and decompisition of some New Brunswick peats. ASTM Symposium on the Testing of Peats and Organic Soils, June 23, 1982, Toronto, Ontario. (In press)

TOLONEN, K., KEYS, D., and KLEMETTI, V. 1982. Predicting energy content of *in situ* peats by means of their moisture content and bulk density. Suo 33, 1982 (1): 17-24.

ALBERT FORMATION MAPPING PROJECT (*C. St. Peter*)

The Lower Carboniferous Albert Formation in the Moncton Subbasin of southeastern New Brunswick was examined during the summer of 1982 with the purpose of defining and mapping depositional facies. The Formation was also studied for structural deformation to assess the significance of regional faults that control the distribution of the various facies.

The Albert Formation comprises five major facies -- alluvial fan, fluvial, deltaic, evaporitic and lacustrine (Figure 11).

The alluvial fan facies is confined to the southeastern edge of the Subbasin and comprises debris flow conglomerate, sandstone and mudstone.

The fluvial rocks occur in the western and northern parts of the Subbasin and comprise fining-upward sequences of channel conglomerates, point bar sandstones, and overbank siltstones and shales.

The deltaic facies is present in the western, northern and southeastern parts of the Subbasin. The facies is dominated by cross-laminated sandstone, siltstone and claystone. The deltaic strata south of Moncton have yeilded oil and gas from the Stoney Creek Oilfield since 1909.

The evaporite facies occurs in the subsurface near Gautreau in the southeast and near Cornhill in the northwestern part of the area. The evaporites are impure rock salt, gypsum, anhydrite, limestone, and minor glauberite

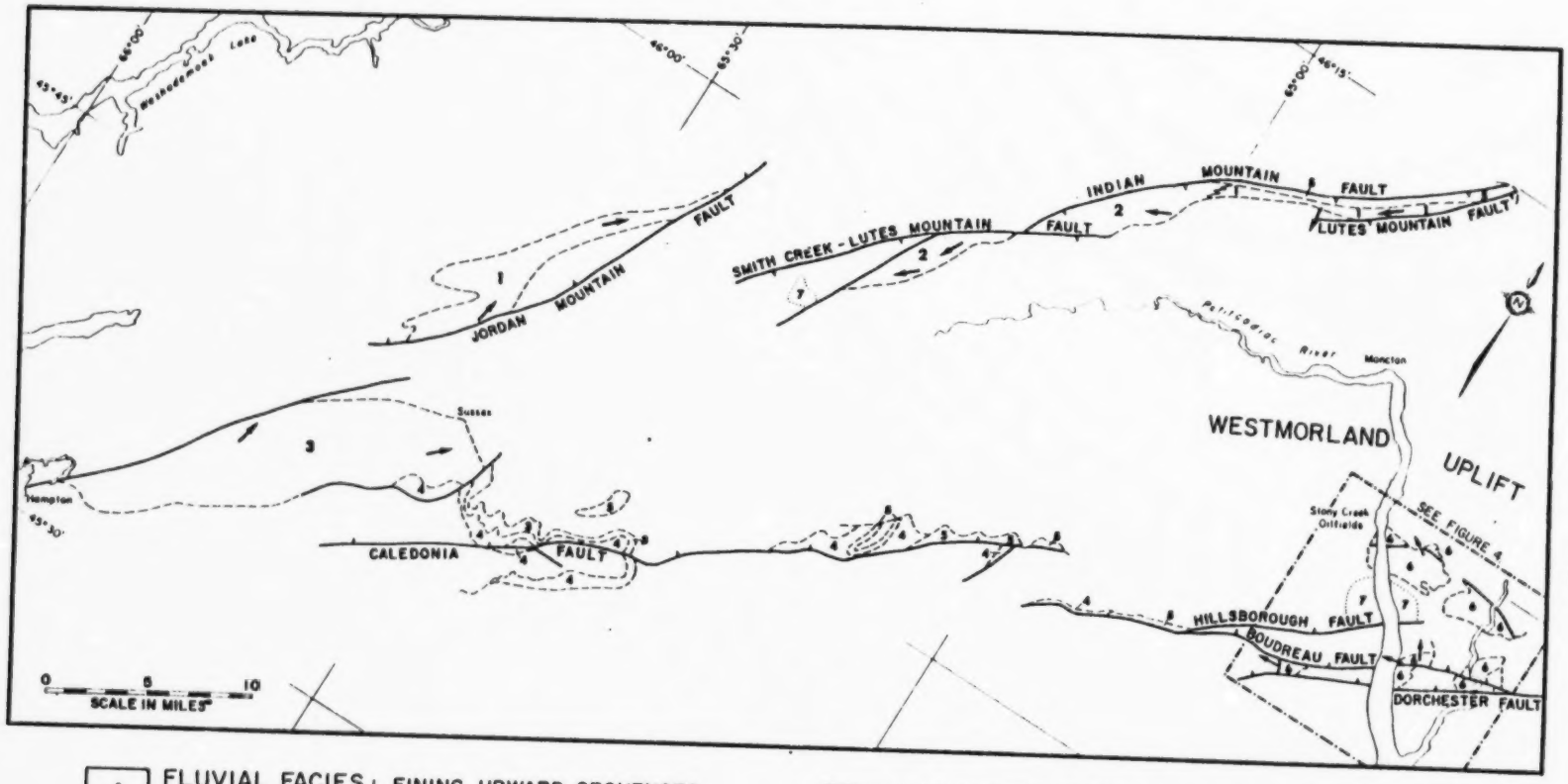

JORDAN MOUNTAIN FAULT
SMITH CREEK - LUTES MOUNTAIN FAULT
INDIAN MOUNTAIN FAULT
LUTES MOUNTAIN FAULT
WESTMORLAND UPLIFT
CALEDONIA FAULT
HILLSBOROUGH FAULT
BOUDREAU FAULT
DORCHESTER FAULT
SEE FIGURE 4
Moncton
Petitcodiac River
Sussex
Hampton
Stony Creek Oilfields
SCALE IN MILES
1 FLUVIAL FACIES: FINING UPWARD SEQUENCES OF CONGLOMERATE, CROSS-BEDDED AND RIPPLE-LAMINATED SANDSTONE, SILTSTONE AND SHALE
2 DELTAIC FACIES: CROSS-LAMINATED SANDSTONE; SILTSTONE AND CLAYSTONE; MINOR CONGLOMERATE AND LIMESTONE
3 FLUVIAL AND DELTAIC FACIES: UNDIVIDED
4 ALLUVIAL FAN FACIES: DEBRIS FLOW CONGLOMERATE, PEBBLY SANDSTONE AND MUDSTONE; MINOR KEROGENOUS SHALE
5 LACUSTRINE FACIES: DOLOMITIC AND/OR CALCAREOUS KEROGENOUS SHALE, SILTSTONE, SANDSTONE AND BLOCKY LAMINITE
6 DELTAIC AND/OR LACUSTRINE FACIES: UNDIVIDED
7 EVAPORITE FACIES: (SUBSURFACE) SHALE, LIMESTONE, ANHYDRITE, ROCK SALT AND GLAUBERITE
PALEOCURRENT DIRECTIONS FROM FLUVIAL AND DELTAIC STRATA

Figure 11: Albert Formation Facies, Moncton Subbasin

that occur as nodules and stringers intercalated with grey and red shale.

The lacustrine facies (generally, oil shale) is mainly restricted to the southern and southeastern parts of the Subbasin. The rocks are kerogen-bearing, dolomitic shale, siltstone, sandstone and laminite. The laminite averages by volume: 32 per cent organic matter, 13 per cent dolomite, 4 per cent calcite, and 51 per cent clastic minerals. Upon pyrolysis the laminite yields about 125 litres of shale oil per tonne.

The Albert Formation shows evidence of two phases of deformation that are attributable to Carboniferous tectonism. During Mississippian time the rocks were displaced by several regional reverse and/or thrust faults. The faults were reactivated in late Mississippian to early Pennsylvanian time resulting in further displacement. Tectonic melange zones, breccia zones and recumbent folds in the southeastern part of the area indicate that faults have greatly affected the distribution of th economically important oil shales.

The results of this project are more fully described in a forthcoming paper (St. Peter 1983).

ST. PETER, C. 1983. Geology of the Albert Formation, New Brunswick, Canada. *In* 1982 Eastern Oil Shale Symposium, Kentucky Department of Energy, University of Kentucky, Institute for Mining and Minerals Research, Lexington, Kentucky.

GEOLOGY DEPARTMENT
UNIVERSITY OF NEW BRUNSWICK

P.F. Williams, Chairman of Department

Despite increasing stringencies in University funding, the Department had quite a successful year. Approximately 50 articles and abstracts were published and we were quite successful in obtaining support for research, principally from external sources. We received a total of $132,252 from NSERC in equipment grants for automation of the XRF (Dr. N.J. Susak), for a new XRD unit (Dr. L.T. Trembath) and for purchase of a double tilt specimen holder for the transmission electron microscope (Dr. J.C. White). The MPHEC awarded $48,173 for an experimental geochemical laboratory for Dr. Susak. A $50,000/year for 3 years NSERC infrastructure grant for operation of the University Electron Microscope Unit was obtained in collaboration with the Biology Department and with support from other departments, and DNR awarded $30,000 to Dr. R.K. Pickerill for support of a project on the Albert Oil Shales. Additional support was received from UNB Research Fund, E.M.R., Gulf Canada, Shell Canada Resources, Brunswick Mining and Smelting, Heath Steele Mines Ltd., Seabright Resources Inc., CIMM, Chevron, Riocanex, Consolidated Rambler.

Student numbers increased significantly this year and undergraduate class enrollments for the 1982-1983 year were up approximately 50% on 1981-1982. This increase was partly due to the Geological Engineering program which is now well underway with 44 students in all years and the first graduates expected in 1983. Resident graduate student numbers rose slightly to 20 and the total graduate enrollment rose to 35. The number of graduate students working on resource-oriented projects is a little more than one third of the total. The increase in undergraduate students has put quite a strain on our resources both in terms of equipment and staff, and I believe that we will

have to consider restricting numbers next year.

Dr. N.J. Susak joined the faculty in January this year and he is presently revising our courses in Geochemistry as well as setting up an experimental and analytical laboratory to work on geochemical processes relevant to sulphide deposits. Other newcomers to the Department this year include Mr. David Pirie and Mr. Jaan Vahtra. David, as Chief Technician, is upgrading our technical services and amongst other things, is doing an excellent job of preventing our antiquated slide preparation workshop from grinding to a halt. Jaan, who replaces Chary Kandalam, only joined us 2 months ago and has been busy ever since with automation of the XRF and with bringing it back on-line. We also had three Post Doctoral Fellows in the Department this year; two, Dr. K. Karlstrom and Dr. C. Mawer working in tectonics and rock deformation and the third, Dr. A.G. Plint, working on physical diagenesis.

The Department was honoured this year when Dr. Arnie McAllister's contribution to the mineral industry of Canada was acknowledged at the CIMM's District One meeting in Fredericton. He received both the CIMM's National Proficiency Medal and the Dr. W.J. Wright Award.

The various projects in progress during the past year are listed below under discipline headings.

Regional Mapping Projects

Several members of the Department continue to be active in regional studies. R.H. Grant is continuing with his studies of Variscan tectonics west of Saint John and Dr. R.K. Pickerill, in collaboration with Dr. K.L. Currie of G.S.C., Dr. D. Nance of the University of Ohio and a graduate student, is involved in regional mapping in the Saint John area (N.B.). I. Patel is working on the Precambrian - Cambrian boundary in New Brunswick.

Dr. P. Stringer and Dr. K.B.S. Burke are combining geological and geophysical mapping to trace the extent of

Triassic dykes in the St. Andrews - St. George area (N.B.) and have distinguished pre- and post-Triassic displacements on major strike-slip faults.

Dr. H.W. van de Poll, I. Patel, Dr. A.G. Plint and graduate students are continuing mapping and basin analysis of Carboniferous and Lower Permian Strata in eastern Canada and have specific project areas at present, around Windsor and Truro (N.S.), Parrsboro (N.S.), Tynemouth Creek (N.B.), Apple River and Joggins (N.S.), and Sydney Basin (N.S.) and on Prince Edward Island.

Dr. P.F. Williams together with Dr. Karl Karlstrom and postgraduate students continues mapping in the Dunnage Zone around eastern Notre Dame Bay (Nfld.). Mapping is being carried out at various scales from 1:12,500 to 1:100 and results are being compiled at 1:50,000. Approximately 50% of the area covered by four 1:50,000 sheets has now been mapped.

Economic Deposits and Mineralization

The Department continues to be active in the economic field. Dr. A.L. McAllister, who is presently on sabbatical leave, has several projects in progress. His research continues to emphasize the general characteristics of mineral deposits and their environment. Current projects within the Atlantic Provinces are mainly centered upon Rambler, Key Anacon and Heath Steele, all massive volcanogenic deposits. One project is oriented toward the geochemical detection of weather-resistant mineralization. Projects outside the Atlantic Provinces being carried on by students include uranium occurrences in the Bancroft area and gold mineralization in the Adirondacks. Dr. D.J. Bachinski and graduate students continue work on massive sulphide occurrences in the Canadian Appalachians with detailed studies at Brunswick 6, Austin Brook and Rambler in Newfoundland. Results of this work were presented at the CIMM District One meeting in Fredericton. He is also supervising a graduate student project on hydrodynamic models and hydrothermal

ore deposits in sedimentary environments. This work focuses on artesian potential models.

Dr. W.E. Hale was on sabbatical leave for the first half of this year. He has been supervising a D.N.R.- and Shell-supported study of uranium and thorium distribution in rocks of southwest New Brunswick and that project is now nearing completion. His work on gold in Nova Scotia, involving a graduate student, is continuing and studies are being made of vein and offshore placer deposits as well as old tailings.

Dr. P.F. Williams and Dr. D.J. Bachinski continue supervision of a graduate student project in the area of Brunswick 6 and 12 Mines and Austin Brook. The work so far seems to indicate that the economic mineralization is controlled by F_2 folding and much of the mineralization seems to have been remobilized during deformation though it may not have moved very far.

Dr. H.W. van de Poll continues his interest in the economic geology of the Permo-Carboniferous of N.B., N.S. and P.E.I. with emphasis on the lithostratigraphy, sedimentology and paleoclimatic evolution of the Prince Edward Island redbeds for an overall evaluation of their economic potential with respect to gravel, uranium and natural gas. Dr. R.K. Pickerill is continuing supervision of a D.N.R. sponsored graduate project on the Albert Formation. The project involves detailed mapping, stratigraphy and sedimentology and is concerned with delineating the areal distribution of the oil shales.

Geochemistry

Dr. N.J. Susak has begun a program in experimental geochemistry. Initial work is focused on the structure and coordination of transition metal complex ions in ore-forming solutions. This is determined by optical absorption spectrometry. The role of coordination changes on mineral solvation mechanisms and kinetics is also being investigated.

Geophysics

Most of the effort this year has been placed on the investigation of the 1982 Miramichi earthquakes. Dr. K.B.S. Burke has cooperated with J. Chandra of the Department of Natural Resources in a gravity survey of the epicentral region and an interpretation of the gravity and magnetic data is in progress. Initial thickness estimates from the gravity anomalies suggest that the earthquake and its aftershocks are confined to the granitic pluton. Dr. Burke is also continuing with supervision of a graduate project concerned with analysis of the Mini Sosie seismic data along a 120 km line from Wayerton to Herbert (N.B.). An interpretation of the seismic signature of the Carboniferous sediments is being made and the relief on the Pre-Carboniferous basement surface investigated. An analysis has also been made of the velocity logs from a number of boreholes in the Carboniferous Basin.

Palaeontology

Dr. A. Logan is continuing actuopalaeontological studies of modern hard substrate communities in the Bay of Fundy with a view to ascertaining their value for palaeoecological reconstruction in the Mesozoic. He is also working on competitive interactions of hermatypic corals in Bermuda and their significance in terms of distribution and succession of similar species in Tertiary and Pleistocene reefs. Dr. J.P.A. Noble together with a graduate student has continued his studies of Palaeozoic fossil assemblages with emphasis on corals and stromatoporoids.

Dr. R.K. Pickerill, who this year was elected Vice President of the Palaeontological Division of G.A.C. is working on the structure, composition, ecology and evolution of Silurian brachiopod dominated communities of Arisaig (N.S.) with Dr. J.M. Hurst. Additionally, he is making a study of the structure, composition and evolution of Ordovician marine benthic communities in Quebec with Dr. T.L. Harland and in Wales with Dr. P.J. Brenchley. He is also collaborating with Dr. M. Wade of

the Queensland Museum, Australia, in a study of Cambrian jellyfish from the Saint John area. He continues his extensive trace fossil research in Quebec, Newfoundland and New Brunswick and is now initiating a similar project in Oregon.

Petrology

Dr. S.W. Bachinski is working on the geochemistry, mineralogy and petrology of lamprophyres from New Brunswick and elsewhere and Dr. L.T. Trembath is studying crystallization of feldspar in synthetic and natural systems. This latter project is concerned with a comparison of microstructure in natural and experimentally produced, compositionally equivalent crystalline material and is aimed at developing a better understanding of the crystallization and emplacement of granitoids.

Sedimentology

Dr. J.P.A. Noble was on sabbatical leave in France early this year and he carried out a study of Siluro-Devonian carbonates and reefs in the Massif Amoricain for comparison with Appalachian basins. He has also continued with stratigraphic and sedimentary studies, including a study of diagenesis, in northern New Brunswick and Gaspé as part of a Silurian-Devonian Appalachian basin project.

I. Patel is continuing a study of the sedimentology of the early lower Cambrian, Ratcliffe Brook Formation in southeastern New Brunswick and is attempting correlation with similar sequences in parts of the northern Appalachians and Europe.

Dr. R.K. Pickerill is contributing sedimentological work to a regional study of the Saint John group as mentioned above.

In addition to the obvious sedimentological bias of their regional project mentioned above, Dr. H.W. van de Poll, I. Patel and Dr. A.G. Plint are continuing work on physical diagenesis. They are augmenting this study with laboratory tank experiments, by means of which they are simulating many of the structures observed in the field. This work has implications for petroleum reservoir studies and metallogenesis of certain low temperature,

sediment-hosted mineral deposits.

Structural Geology

Dr. P. Stringer is continuing structural mapping in the Oak Bay area, St. Stephen (N.B.). He is also working in the Fieldings Cove area of southern N.B. on the supposed Triassic Lepreau Formation. His work there indicates intense deformation correlative with the Hercynian (Carboniferous) orogeny. Samples of cleaved shales have been submitted to the G.S.C. and to Pennsylvania State University for palynological age determination. The deformation of a Paleozoic granite in fault contact with the Lepreau Formation is also being investigated by Dr. Stringer and he will be joined in this work by a Post Doctoral Fellow, Dr. H. Stel.

Dr. J.C. White has set up a laboratory for preparation of transmission electron microscopy specimens and is continuing EM studies of fault materials with a view to characterizing the deformation mechanisms. This summer he started a project on the Cobequid Fault Zone in the Parrsboro area (N.S.) and on its possible extensions in N.B. He is also supervising an honours project involving a scanning electron microscope study of slate.

Dr. P.F. Williams completed a study of microstructural development and deformation mechanisms in rocks from the Carmanville area (Nfld.). Further studies of this type are planned for other rocks from the Notre Dame Bay area (see above) and a similar graduate study project is in progress on slates from New World Island. The work involves both optical and electron microscopy. A microstructural project has also been begun recently in collaboration with Dr. C. Mawer on rocks associated with the Chedabucto Fault. Dr. Williams also has continuing work in collaboration with Dr. P. Stringer on cleavage transected folds from the Bathurst area (N.B.). This year he began a new project together with Dr. G.P. Price of CSIRO, Australia to construct a semi-automated fabric stage for rapid fabric measurement. Dr. Price has been awarded a Commonwealth Fellowship to visit UNB for 6 months next year.